

## Getting Started with ArcExplorer—Java Edition for Education – Lesson 3

This lesson covers the following ideas, tools, and capacities:

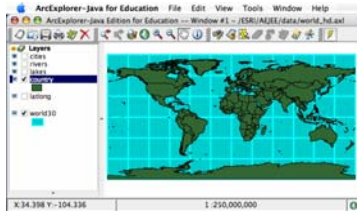
- Map projection
- Scale
- Measuring distance
- Overview map
- Exporting an image
- Layouts

1.



Start AEJEE. Choose to open an existing project by clicking the "**Open...**" button or choose the menu item "**FILE/OPEN**". Navigate to where AEJEE data and projects are stored and choose **world\_hd.axl**. Click the file and click "**Open**".

2.



The map opens showing the world in what is called a "geographic" or "lat-long" display. Look at the Status Bar at the bottom of the screen and move your mouse around the map. It will show the location of the mouse using latitude and longitude, expressed as decimal degrees.

3.

This "decimal degree" display works because the data are stored in a decimal degree coordinate system. AEJEE can also "project on the fly" any feature data (shapefiles of points, lines, and polygons) that are stored in decimal degree. Let's try.

4.

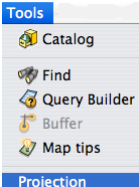


Create a new AEJEE window by choosing the menu item "**Window/New Window**". Open the project "**world\_hd2.axl**"

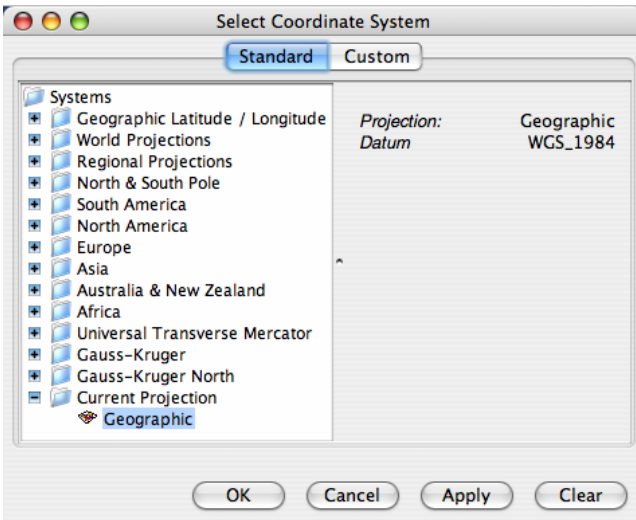
**NOTE:** One of the biggest challenges facing cartographers is that of representing a spherical surface on a flat piece of paper or computer screen. Even if the earth were perfectly spherical (which it is not), showing a 3D object in a 2D space would involve distortion of distance, area, shape, or direction, or some combination thereof. Whole courses of study exist to deal with coordinate systems, projections, and datums; it is worthwhile exploring these. This lesson uses these definitions:

- **coordinate system** = reference system of points, lines, and/or surfaces, and rules defining positions of points in space (e.g. geographic, or Cartesian). GIS data are typically stored with reference to a specific coordinate system.
- **projection** = mathematical formulas by which a curved surface is portrayed on a flat surface (e.g. conformal, equal area, or azimuthal)
- **datum** = collection of defined positions of the earth surface, giving a frame of reference for measuring (e.g. North American Datum of 1983, or "NAD83")

5. The data in the two projects are exactly the same; only the projection is different. AEJEE projects (the **.axl** files you open) store information about the projection used at the time of saving.

6.  It's quite easy to change the projection. Bring the first map window (with the rectangular display) to the front. Choose the menu item **"Tools/Projection"**.

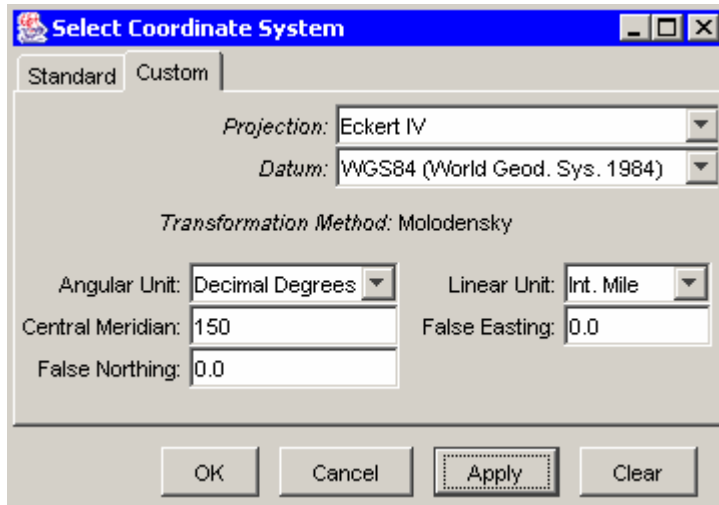
**NOTE:** Whenever you work with multiple map windows in AEJEE, it's crucial to make sure the desired map window is in front when you begin an operation.

7. 

It can look a little intimidating at first, but AEJEE contains a large number of pre-defined, standard coordinate systems. Usually, all you need to do is select the one you want. Notice that the **"Standard"** tab is currently selected. If you click **"Custom"**, you can modify various parameters. For now, return to **"Standard"** and notice that the current projection is highlighted at the bottom. From the list, click the **"+"** next to **"World Projections"** to spill it open. Open **"World Projections (Sphere)"**, and scroll down to choose **"Orthographic"**. For now, ignore the information that appears at right, and just click **"OK"**.

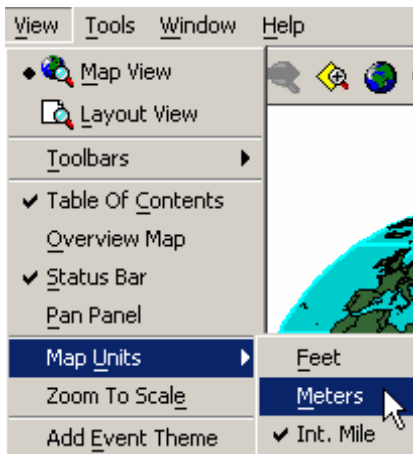
8. Your two map displays should now be identical, so close the window showing **"world\_hd2.axl"**.
9. Try a few other world projections, using the same process. Try in order these several types: Robinson, Sinusoidal, Peters, Mercator, and Bonne. (If your map ever seems to "disappear", right-click the **"country"** layer and choose **"Zoom to Layer"**.) Which projection do you like best? Why?
10. Now let's try a custom projection. First, set the projection to **"Eckert IV"**, a nice "equal area" projection. Click **"Apply"** rather than **"OK"**, so the **"Select Coordinate System"** window stays open. Suppose we want to remain in this projection but, instead of an Atlantic-centered map, which breaks the world at the 180<sup>th</sup> meridian, we'd like to have a map centered on the Pacific ocean. We can do this by customizing the projection.

11.



In the **"Select Coordinate System"** window, click the **"Custom"** tab near the top. Notice that you can click back and forth between **"Custom"** and **"Standard"** if you want to refer to information. For now, in the **"Custom"** window, set your pull-downs to match the picture here. Setting the central meridian at 150 means the "left and right edges" of the map will be at 30 degrees west. Click **"OK"**, then **"Zoom to Full Extent"**.

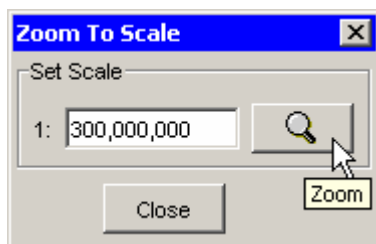
12.



One more adjustment to make back in the map. Having adjusted the projection, the scale bar may provide an incorrect reading like "1:1". If so, we need to adjust the units. Under the menu item **"View/Map Units"**, choose **"meters"**, because the projected space is expecting the data to be presented as meters. Now your map should give you an appropriate scale.

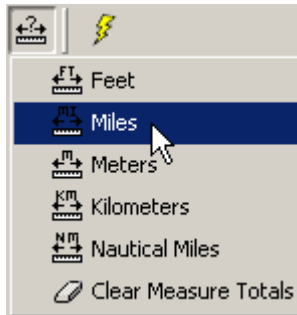
**NOTE:** "Scale" can be a challenging concept to handle. It may be easiest to think of the map's scale as it is represented here – a ratio, or fraction. In a map with a scale of 1:300,000,000, one "unit of measure" (any size) on the map represents 300,000,000 of those same units in real life. The visible number is the "denominator" in a fraction. Making that visible number larger creates a smaller fraction, and a "smaller scale map;" a smaller denominator means a "larger scale map". See the "introduction to cartography" document referenced in the "Intro to AEJEE" for more guidance.

13.



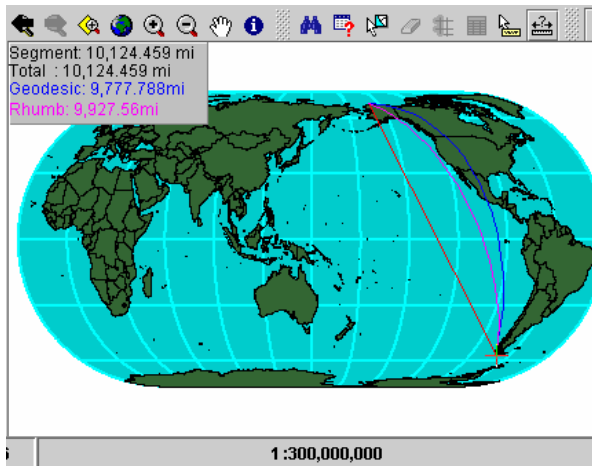
Now that the map is set as you like, suppose you'd like to have the scale be a nice round number, perhaps **1:300,000,000**. It's easy to set the scale. Choose the menu item **"View/Zoom To Scale"**. Click in the box that appears and type the desired number (you can use commas or leave them out, as you prefer), and click **"Zoom"**. The map scale will adjust as you have indicated.

14.



Having set the projection and established a scale, let's explore measuring distances. In the **"Advanced"** toolbar, click the **"Measure"** tool. A series of choices appears. While the others may be useful for different maps, for now choose **"Miles"**. This will give us measurements in miles.

15.

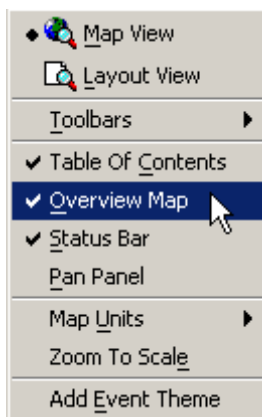


Click-and-hold on the northern edge of Alaska and drag to draw a straight line to the southern tip of South America. As you move, a trio of lines appears, and a new box appears listing several numbers. The blue line is a **"geodesic"** line, or great circle route. The magenta line is a **"rhumb"** line, or line of constant angle from start to finish. The red line (with black numbers) is the **"segment"** and **"total"** length as drawn on the map. If the numbers seem confused, remember that the map is projected, and the shortest distance on a sphere is a great circle. Clear the measurements (double-click in the map) and try another measurement, from northern Alaska to the southern tip of Africa. Then try it from Seattle to northern Japan.

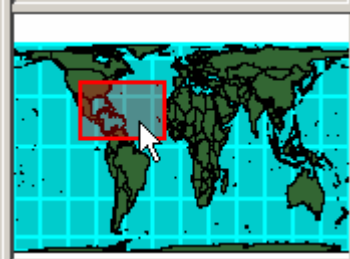
16.


Change the projection to "Peters" (use "Standard" tab), zoom out to the world, and try those three measurements again. Notice how the projection capacity and measuring tool combine to show the challenge of representing a sphere in 2D.

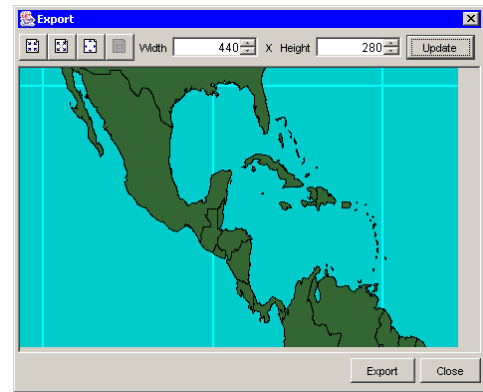
17.



Sometimes, while zooming around a map, it is helpful to have an overview of where you are on the map. AEJEE allows you to set an overview map space and use in the overview map any layer from the TOC. From the menu bar choose the menu item **"View/Overview Map"**. A new space will appear at the bottom of the TOC, separated from the rest of the TOC. In the TOC, right-click **"world30"** and choose **"Use in Overview Map"**. This layer is displayed in the overview, with a red border around the area currently displayed in the map. Do the same again with the **"country"** layer. Finally, in the main map, zoom in around one continent and see what happens in the overview map.

18.  The overview map isn't just a handy reference. It can also be a quick way to wander around the map. Zoom in to a small region on the main map, and notice the red area highlighted in the overview map. Now, with your mouse, drag the highlighted area in the overview map to a different part of the overview map. What happens to the main map? This can be a very useful way to compare regions in a map.

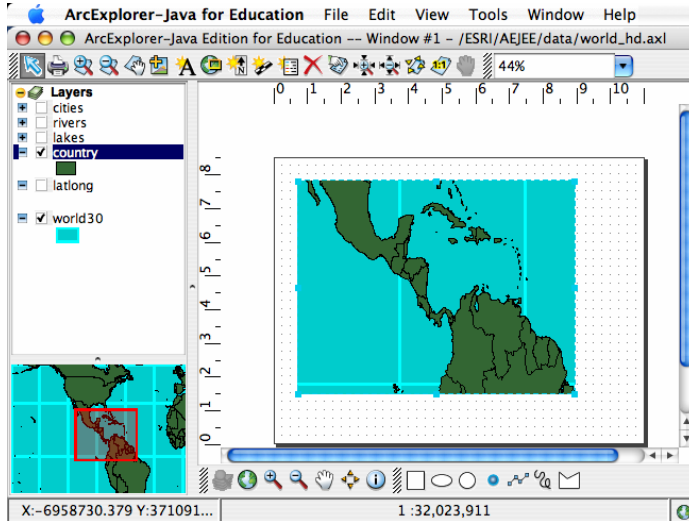
19.  When the map shows just what you want, you may want to print the map, or export it as a graphic. If you're connected to a printer, try using the menu item "**File/Print**". You can print the contents of the view – just the main map. (See the "Intro to AEJEE" document for a discussion of distribution rights.)

20.  You can also export the contents of the main map by choosing "**File/Export to Image**". The export window allows you to choose the size of the image, by changing one dimension (width or height) and clicking "**Update**". When you're ready, choose "**Export**" and select the destination (such as "/ESRI/AEJEE") and the file type (such as JPG or PNG). You can then incorporate it in a printed or electronic document. (See the "Intro to AEJEE" document about distribution rights.)

21. But what if you want to set up your exported image to include a legend, a scale bar, and perhaps some additional graphics on the map? You need to create a "layout". First, create the map you'd like to export. Try something basic, like the map above. Then, from the menu bar, choose "**View/Layout View**".

**NOTE:** Once you have "the right map", designing an attractive and functional layout is a matter of graphic design and communication skills. It is critical to be familiar with standard practices in graphics software before working with layouts.

22.



Refer to the "Intro to AEJEE" document for an overview of the layout interface. Click the **"Zoom to whole page"** button to see a miniature of the entire page.

23.

The layout opens with only one element -- a map element. Right-click the map graphic element and choose **"Properties"**. Click the **"Frame"** tab, and set a border using a solid line, width **"2"**. Leave everything else unchanged and click **"OK"**. Be sure the map element leaves enough empty space on the page for the other elements. If there is not enough empty space, re-size the map element by left-clicking it once to select it, then use the graphic handles to re-size.

24.



In the layout, click the map element once to select it. Now click the **"Add map legend"** button. A small graphic with handles will appear on the page. Drag the legend to some empty space in the page. Right-click the legend element and choose **"Properties"**. Under the **"Frame"** tab, set a solid line border of width **"2"**, and set a **"Gap X"** and **"Gap Y"** of **"6"** points. Leave the rest unchanged and click **"OK"**.

25.




In the layout, click the map element once to select it. Now click the **"Add map scale bar"** button. Choose the **"Alternating Scale Bar"** and click **"OK"**. A small graphic with handles will appear on the page; drag it to some empty space on the page. It's likely that the scale did not appear in nice round numbers, so right-click the scale and choose **"Properties"**. In the **"Scale and Units"** tab, set **"When resizing..."** to **"Adjust number of divisions"**. Change **"Division value"** to a nice round number. Then set **"Units/Label Position"** to **"below bar"**. Leave the other properties unchanged and click **"OK"**. Back on the layout, your scale bar should adjust itself and show nice round numbers.

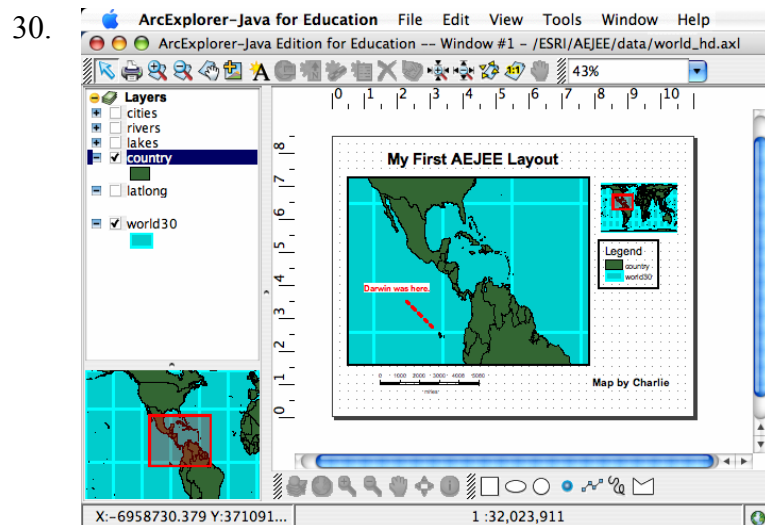
26.



In the layout, click the map element once to select it. Now click the **"Add overview map"** button. Another small graphic appears on the page, showing a miniature of the overview map you had set up. Drag this to some empty space on the page.



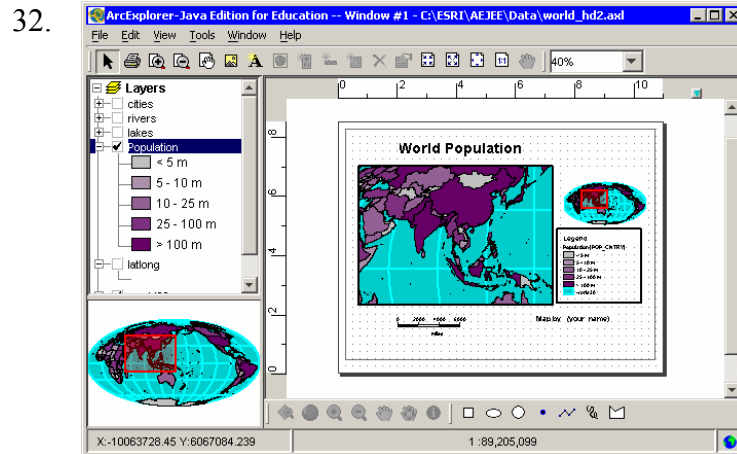
27. In the layout, click the map element once to select it. The zoom tools below the layout control the area of the main map, just like they did before you switched into "Layout" view. Suppose you want to zoom out from the area being shown in the map just a little bit. Click the "**Zoom Out**" magnifying glass and click once in the center of the map. The map will zoom out a bit, but still occupy the same space on the page. Because the scale bar and the overview map are tied to the main map, the scale bar and the overview map will each adjust a little bit.
28.  Next, you want to add a couple of text elements to the page. Let's start with a title. Click an empty space on the layout to de-select any elements that might be selected. Click the "**Add Text**" button. A small graphic window containing the words "Right-click this text" appears on the page. (Look closely; it may be hard to find.) Drag the text box to an empty space on the page. Right-click the text graphic element and choose "**Properties**". In the textbox, type "My First AEJEE Layout". Click the "**Change Properties...**" button and choose a simple font like **Arial**, set the size to **36**, choose "**Bold**", and click "**OK**". Back on the layout, it should be easier to see; move it to the top of the page. In similar fashion, create a text box indicating the map's author.
29. Finally, let's add a simple graphic, highlighting some feature in the map. Click the "**New Line**" tool below the map. Click and drag a line (click to start, double-click to stop) from a feature you want to label to some empty space where you can put a label. Graphic handles will appear on the box bounding the line, so right-click it, choose "**Properties**", and make the line a red dashed line of width "**2**". Create a text box to provide the desired info about that feature.



Ready to export your layout? From the menu bar, choose "**File/Export to image**". A dialog box appears, asking for the desired dots per inch; 72-300 is a reasonable number for printing and creating electronic files. Enter the number and click "**OK**". An export preview appears, in which you can adjust the output size. Finally, choose "**Export**", set the destination folder and file type, and export your image.

31. **REVIEW:** In this lesson, we have covered the following ideas, tools, and capacities:

- Map projection
- Scale
- Measuring distance
- Overview
- Exporting an image
- Layouts



**SELF CHECK:** Now it's time to see if you can use these concepts and skills on a new set of data. Create a new AEJEE window ("**Window/New Window**") and open the project "**world\_hd2.axl**", which you have seen before. Change the map to a Pacific-centered Mollweide map projection, use "POP2005" as the classification field, and create a layout like the one below.

